



#5

SEQUENCE LISTING

<110> Jin, Hong  
Tang, Roderick  
Li, Shengqiang  
Bryant, Martin

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Vaccines

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 1860 1865 1870  
 Tyr Ile Tyr Arg Ser Leu Lys Asp Cys Asn Asp His Ser Leu Pro Ile  
 1875 1880 1885  
 Glu Phe Leu Arg Leu Tyr Asn Gly His Ile Asn Ile Asp Tyr Gly Glu  
 1890 1895 1900  
 Asn Leu Thr Ile Pro Ala Thr Asp Ala Thr Asn Asn Ile His Trp Ser  
 1905 1910 1915 1920  
 Tyr Leu His Ile Lys Phe Ala Glu Pro Ile Ser Leu Phe Val Cys Asp  
 1925 1930 1935  
 Ala Glu Leu Ser Val Thr Val Asn Trp Ser Lys Ile Ile Ile Glu Trp  
 1940 1945 1950  
 Ser Lys His Val Arg Lys Cys Lys Tyr Cys Ser Ser Val Asn Lys Cys  
 1955 1960 1965  
 Met Leu Ile Val Lys Tyr His Ala Gln Asp Asp Ile Asp Phe Lys Leu  
 1970 1975 1980  
 Asp Asn Ile Thr Ile Leu Lys Thr Tyr Val Cys Leu Gly Ser Lys Leu  
 1985 1990 1995 2000  
 Lys Gly Ser Glu Val Tyr Leu Val Leu Thr Ile Gly Pro Ala Asn Ile  
 2005 2010 2015  
 Phe Pro Val Phe Asn Val Val Gln Asn Ala Lys Leu Ile Leu Ser Arg  
 2020 2025 2030  
 Thr Lys Asn Phe Ile Met Pro Lys Lys Ala Asp Lys Glu Ser Ile Asp  
 2035 2040 2045  
 Ala Asn Ile Lys Ser Leu Ile Pro Phe Leu Cys Tyr Pro Ile Thr Lys  
 2050 2055 2060  
 Lys Gly Ile Asn Thr Ala Leu Ser Lys Leu Lys Ser Val Val Ser Gly  
 2065 2070 2075 2080  
 Asp Ile Leu Ser Tyr Ser Ile Ala Gly Arg Asn Glu Val Phe Ser Asn  
 2085 2090 2095  
 Lys Leu Ile Asn His Lys His Met Asn Ile Leu Lys Trp Phe Asn His  
 2100 2105 2110  
 Val Leu Asn Phe Arg Ser Thr Glu Leu Asn Tyr Asn His Leu Tyr Met  
 2115 2120 2125  
 Val Glu Ser Thr Tyr Pro Tyr Leu Ser Glu Leu Leu Asn Ser Leu Thr  
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 Asn Phe His Asn Glu  
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Ser	Tyr	Ile	Phe	Asn	Gly	Pro	Tyr	Leu	Lys	Asn	Asp	Tyr	Thr	Asn	Leu
		35					40					45			
Ile	Ser	Arg	Gln	Asn	Pro	Leu	Ile	Glu	His	Met	Asn	Leu	Lys	Lys	Leu
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Asn	Ile	Thr	Gln	Ser	Leu	Ile	Ser	Lys	Tyr	His	Lys	Gly	Glu	Ile	Lys
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Leu	Glu	Glu	Pro	Thr	Tyr	Phe	Gln	Ser	Leu	Leu	Met	Thr	Tyr	Lys	Ser
				85					90					95	
Met	Thr	Ser	Ser	Glu	Gln	Ile	Ala	Thr	Thr	Asn	Leu	Leu	Lys	Lys	Ile
			100					105					110		
Ile	Arg	Arg	Ala	Ile	Glu	Ile	Ser	Asp	Val	Lys	Val	Tyr	Ala	Ile	Leu
		115						120					125		
Asn	Lys	Leu	Gly	Leu	Lys	Glu	Lys	Asp	Lys	Ile	Lys	Ser	Asn	Asn	Gly
		130				135					140				
Gln	Asp	Glu	Asp	Asn	Ser	Val	Ile	Thr	Thr	Ile	Ile	Lys	Asp	Asp	Ile
145					150					155					160
Leu	Ser	Ala	Val	Lys	Asp	Asn	Gln	Ser	His	Leu	Lys	Ala	Asp	Lys	Asn
				165					170					175	
His	Ser	Thr	Lys	Gln	Lys	Asp	Thr	Ile	Lys	Thr	Thr	Leu	Leu	Lys	Lys
			180					185						190	
Leu	Met	Cys	Ser	Met	Gln	His	Pro	Pro	Ser	Trp	Leu	Ile	His	Trp	Phe
		195					200					205			
Asn	Leu	Tyr	Thr	Lys	Leu	Asn	Asn	Ile	Leu	Thr	Gln	Tyr	Arg	Ser	Asn
		210				215					220				
Glu	Val	Lys	Asn	His	Gly	Phe	Thr	Leu	Ile	Asp	Asn	Gln	Thr	Leu	Ser
225					230					235					240
Gly	Phe	Gln	Phe	Ile	Leu	Asn	Gln	Tyr	Gly	Cys	Ile	Val	Tyr	His	Lys
				245					250					255	
Glu	Leu	Lys	Arg	Ile	Thr	Val	Thr	Thr	Tyr	Asn	Gln	Phe	Leu	Thr	Trp
			260					265						270	
Lys	Asp	Ile	Ser	Leu	Ser	Arg	Leu	Asn	Val	Cys	Leu	Ile	Thr	Trp	Ile
			275					280						285	
Ser	Asn	Cys	Leu	Asn	Thr	Leu	Asn	Lys	Ser	Leu	Gly	Leu	Arg	Cys	Gly
		290				295					300				
Phe	Asn	Asn	Val	Ile	Leu	Thr	Gln	Leu	Phe	Leu	Tyr	Gly	Asp	Cys	Ile
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Leu	Lys	Leu	Phe	His	Asn	Glu	Gly	Phe	Tyr	Ile	Ile	Lys	Glu	Val	Glu
				325					330					335	
Gly	Phe	Ile	Met	Ser	Leu	Ile	Leu	Asn	Ile	Thr	Glu	Glu	Asp	Gln	Phe
			340					345						350	
Arg	Lys	Arg	Phe	Tyr	Asn	Ser	Met	Leu	Asn	Asn	Ile	Thr	Asp	Ala	Ala
		355					360						365		
Asn	Lys	Ala	Gln	Lys	Asn	Leu	Leu	Ser	Arg	Val	Cys	His	Thr	Leu	Leu
		370				375					380				
Asp	Lys	Thr	Val	Ser	Asp	Asn	Ile	Ile	Asn	Gly	Arg	Trp	Ile	Ile	Leu
385					390					395					400
Leu	Ser	Lys	Phe	Leu	Lys	Leu	Ile	Lys	Leu	Ala	Gly	Asp	Asn	Asn	Leu
			405						410					415	
Asn	Asn	Leu	Ser	Glu	Leu	Tyr	Phe	Leu	Phe	Arg	Ile	Phe	Gly	His	Pro
			420					425					430		
Met	Val	Asp	Glu	Arg	Gln	Ala	Met	Asp	Ala	Val	Lys	Ile	Asn	Cys	Asn
		435					440						445		
Glu	Thr	Lys	Phe	Tyr	Leu	Leu	Ser	Ser	Leu	Ser	Met	Leu	Arg	Gly	Ala
					455						460				
Phe	Ile	Tyr	Arg	Ile	Ile	Lys	Gly	Phe	Val	Asn	Asn	Tyr	Asn	Arg	Trp
465					470					475					480
Pro	Thr	Leu	Arg	Asn	Ala	Ile	Val	Leu	Pro	Leu	Arg	Trp	Leu	Thr	Tyr
				485					490					495	
Tyr	Lys	Leu	Asn	Thr	Tyr	Pro	Ser	Leu	Leu	Glu	Leu	Thr	Glu	Arg	Asp
			500					505						510	

Leu	Ile	Val	Leu	Ser	Gly	Leu	Arg	Phe	Tyr	Arg	Glu	Phe	Arg	Leu	Pro	515	520	525
Lys	Lys	Val	Asp	Leu	Glu	Met	Ile	Ile	Asn	Asp	Lys	Ala	Ile	Ser	Pro	530	535	540
Pro	Lys	Asn	Leu	Ile	Trp	Thr	Ser	Phe	Pro	Arg	Asn	Tyr	Met	Pro	Ser	545	550	555
His	Ile	Gln	Asn	Tyr	Ile	Glu	His	Glu	Lys	Leu	Lys	Phe	Ser	Glu	Ser	565	570	575
Asp	Lys	Ser	Arg	Arg	Val	Leu	Glu	Tyr	Tyr	Leu	Arg	Asp	Asn	Lys	Phe	580	585	590
Asn	Glu	Cys	Asp	Leu	Tyr	Asn	Cys	Val	Val	Asn	Gln	Ser	Tyr	Leu	Asn	595	600	605
Asn	Pro	Asn	His	Val	Val	Ser	Leu	Thr	Gly	Lys	Glu	Arg	Glu	Leu	Ser	610	615	620
Val	Gly	Arg	Met	Phe	Ala	Met	Gln	Pro	Gly	Met	Phe	Arg	Gln	Val	Gln	625	630	635
Ile	Leu	Ala	Glu	Lys	Met	Ile	Ala	Glu	Asn	Ile	Leu	Gln	Phe	Phe	Pro	645	650	655
Glu	Ser	Leu	Thr	Arg	Tyr	Gly	Asp	Leu	Glu	Leu	Gln	Lys	Ile	Leu	Glu	660	665	670
Leu	Lys	Ala	Gly	Ile	Ser	Asn	Lys	Ser	Asn	Arg	Tyr	Asn	Asp	Asn	Tyr	675	680	685
Asn	Asn	Tyr	Ile	Ser	Lys	Cys	Ser	Ile	Ile	Thr	Asp	Leu	Ser	Lys	Phe	690	695	700
Asn	Gln	Ala	Phe	Arg	Tyr	Glu	Thr	Ser	Cys	Ile	Cys	Ser	Asp	Val	Leu	705	710	715
Asp	Glu	Leu	His	Gly	Val	Gln	Ser	Leu	Phe	Ser	Trp	Leu	His	Leu	Thr	725	730	735
Ile	Pro	His	Val	Thr	Ile	Ile	Cys	Thr	Tyr	Arg	His	Ala	Pro	Pro	Tyr	740	745	750
Ile	Gly	Asp	His	Ile	Val	Asp	Leu	Asn	Asn	Val	Asp	Glu	Gln	Ser	Gly	755	760	765
Leu	Tyr	Arg	Tyr	His	Met	Gly	Gly	Ile	Glu	Gly	Trp	Cys	Gln	Lys	Leu	770	775	780
Trp	Thr	Ile	Glu	Ala	Ile	Ser	Leu	Leu	Asp	Leu	Ile	Ser	Leu	Lys	Gly	785	790	795
Lys	Phe	Ser	Ile	Thr	Ala	Leu	Ile	Asn	Gly	Asp	Asn	Gln	Ser	Ile	Asp	805	810	815
Ile	Ser	Lys	Pro	Ile	Arg	Leu	Met	Glu	Gly	Gln	Thr	His	Ala	Gln	Ala	820	825	830
Asp	Tyr	Leu	Leu	Ala	Leu	Asn	Ser	Leu	Lys	Leu	Leu	Tyr	Lys	Glu	Tyr	835	840	845
Ala	Gly	Ile	Gly	His	Lys	Leu	Lys	Gly	Thr	Glu	Thr	Tyr	Ile	Ser	Arg	850	855	860
Asp	Met	Gln	Phe	Met	Ser	Lys	Thr	Ile	Gln	His	Asn	Gly	Val	Tyr	Tyr	865	870	875
Pro	Ala	Ser	Ile	Lys	Lys	Val	Leu	Arg	Val	Gly	Pro	Trp	Ile	Asn	Thr	885	890	895
Ile	Leu	Asp	Asp	Phe	Lys	Val	Ser	Leu	Glu	Ser	Ile	Gly	Ser	Leu	Thr	900	905	910
Gln	Glu	Leu	Glu	Tyr	Arg	Gly	Glu	Ser	Leu	Leu	Cys	Ser	Leu	Ile	Phe	915	920	925
Arg	Asn	Val	Trp	Leu	Tyr	Asn	Gln	Ile	Ala	Leu	Gln	Leu	Lys	Asn	His	930	935	940
Ala	Leu	Cys	Asn	Asn	Lys	Leu	Tyr	Leu	Asp	Ile	Leu	Lys	Val	Leu	Lys	945	950	955
His	Leu	Lys	Thr	Phe	Phe	Asn	Leu	Asp	Asn	Ile	Asp	Thr	Ala	Leu	Thr	965	970	975
Leu	Tyr	Met	Asn	Leu	Pro	Met	Leu	Phe	Gly	Gly	Gly	Asp	Pro	Asn	Leu	980	985	990
Leu	Tyr	Arg	Ser	Phe	Tyr	Arg	Arg	Thr	Pro	Asp	Phe	Leu	Thr	Glu	Ala	995	1000	1005

Ile	Val	His	Ser	Val	Phe	Ile	Leu	Ser	Tyr	Tyr	Thr	Asn	His	Asp	Leu
1010						1015					1020				
Lys	Asp	Lys	Leu	Gln	Asp	Leu	Ser	Asp	Asp	Arg	Leu	Asn	Lys	Phe	Leu
1025					1030					1035					1040
Thr	Cys	Ile	Ile	Thr	Phe	Asp	Lys	Asn	Pro	Asn	Ala	Glu	Phe	Val	Thr
				1045					1050					1055	
Leu	Met	Arg	Asp	Pro	Gln	Ala	Leu	Gly	Ser	Glu	Arg	Gln	Ala	Lys	Ile
			1060					1065					1070		
Thr	Ser	Glu	Ile	Asn	Arg	Leu	Ala	Val	Thr	Glu	Val	Leu	Ser	Thr	Ala
		1075				1080						1085			
Pro	Asn	Lys	Ile	Phe	Ser	Lys	Ser	Ala	Gln	His	Tyr	Thr	Thr	Thr	Glu
	1090					1095					1100				
Ile	Asp	Leu	Asn	Asp	Ile	Met	Gln	Asn	Ile	Glu	Pro	Thr	Tyr	Pro	His
1105				1110						1115					1120
Gly	Leu	Arg	Val	Val	Tyr	Glu	Ser	Leu	Pro	Phe	Tyr	Lys	Ala	Glu	Lys
			1125						1130					1135	
Ile	Val	Asn	Leu	Ile	Ser	Gly	Thr	Lys	Ser	Ile	Thr	Asn	Ile	Leu	Glu
		1140						1145					1150		
Lys	Thr	Ser	Ala	Ile	Asp	Leu	Thr	Asp	Ile	Asp	Arg	Ala	Thr	Glu	Met
	1155						1160					1165			
Met	Arg	Lys	Asn	Ile	Thr	Leu	Leu	Ile	Arg	Ile	Leu	Pro	Leu	Asp	Cys
	1170					1175					1180				
Asn	Arg	Asp	Lys	Arg	Glu	Ile	Leu	Ser	Met	Glu	Asn	Leu	Ser	Ile	Thr
1185				1190						1195					1200
Glu	Leu	Ser	Lys	Tyr	Val	Arg	Glu	Arg	Ser	Trp	Ser	Leu	Ser	Asn	Ile
			1205						1210					1215	
Val	Gly	Val	Thr	Ser	Pro	Ser	Ile	Met	Tyr	Thr	Met	Asp	Ile	Lys	Tyr
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Thr	Thr	Ser	Thr	Ile	Ser	Ser	Gly	Ile	Ile	Ile	Glu	Lys	Tyr	Asn	Val
		1235					1240					1245			
Asn	Ser	Leu	Thr	Arg	Gly	Glu	Arg	Gly	Pro	Thr	Lys	Pro	Trp	Val	Gly
	1250					1255					1260				
Ser	Ser	Thr	Gln	Glu	Lys	Lys	Thr	Met	Pro	Val	Tyr	Asn	Arg	Gln	Val
1265				1270						1275					1280
Leu	Thr	Lys	Lys	Gln	Arg	Asp	Gln	Ile	Asp	Leu	Leu	Ala	Lys	Leu	Asp
			1285						1290					1295	
Trp	Val	Tyr	Ala	Ser	Ile	Asp	Asn	Lys	Asp	Glu	Phe	Met	Glu	Glu	Leu
			1300					1305					1310		
Ser	Ile	Gly	Thr	Leu	Gly	Leu	Thr	Tyr	Glu	Lys	Ala	Lys	Lys	Leu	Phe
		1315					1320					1325			
Pro	Gln	Tyr	Leu	Ser	Val	Asn	Tyr	Leu	His	Arg	Leu	Thr	Val	Ser	Ser
	1330					1335					1340				
Arg	Pro	Cys	Glu	Phe	Pro	Ala	Ser	Ile	Pro	Ala	Tyr	Arg	Thr	Thr	Asn
1345				1350						1355					1360
Tyr	His	Phe	Asp	Thr	Ser	Pro	Ile	Asn	Arg	Ile	Leu	Thr	Glu	Lys	Tyr
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Gly	Asp	Glu	Asp	Ile	Asp	Ile	Val	Phe	Gln	Asn	Cys	Ile	Ser	Phe	Gly
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Leu	Ser	Leu	Met	Ser	Val	Val	Glu	Gln	Phe	Thr	Asn	Val	Cys	Pro	Asn
	1395						1400					1405			
Arg	Ile	Ile	Leu	Ile	Pro	Lys	Leu	Asn	Glu	Ile	His	Leu	Met	Lys	Pro
	1410					1415					1420				
Pro	Ile	Phe	Thr	Gly	Asp	Val	Asp	Ile	His	Lys	Leu	Lys	Gln	Val	Ile
1425				1430						1435					1440
Gln	Lys	Gln	His	Met	Phe	Leu	Pro	Asp	Lys	Ile	Ser	Leu	Thr	Gln	Tyr
			1445						1450					1455	
Val	Glu	Leu	Phe	Leu	Ser	Asn	Lys	Thr	Leu	Lys	Ser	Gly	Ser	His	Val
			1460					1465				1470			
Asn	Ser	Asn	Leu	Ile	Leu	Ala	His	Lys	Ile	Ser	Asp	Tyr	Phe	His	Asn
	1475					1480						1485			
Thr	Tyr	Ile	Leu	Ser	Thr	Asn	Leu	Ala	Gly	His	Trp	Ile	Leu	Ile	Ile
	1490					1495						1500			

Gln Leu Met Lys Asp Ser Lys Gly Ile Phe Glu Lys Asp Trp Gly Glu  
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 Gly Tyr Ile Thr Asp His Met Phe Ile Asn Leu Lys Val Phe Phe Asn  
 1525 1530 1535  
 Ala Tyr Lys Thr Tyr Leu Leu Cys Phe His Lys Gly Tyr Gly Lys Ala  
 1540 1545 1550  
 Lys Leu Glu Cys Asp Met Asn Thr Ser Asp Leu Leu Cys Val Leu Glu  
 1555 1560 1565  
 Leu Ile Asp Ser Ser Tyr Trp Lys Ser Met Ser Lys Val Phe Leu Glu  
 1570 1575 1580  
 Gln Lys Val Ile Lys Tyr Ile Leu Ser Gln Asp Ala Ser Leu His Arg  
 1585 1590 1595 1600  
 Val Lys Gly Cys His Ser Phe Lys Leu Trp Phe Leu Lys Arg Leu Asn  
 1605 1610 1615  
 Val Ala Glu Phe Thr Val Cys Pro Trp Val Val Asn Ile Asp Tyr His  
 1620 1625 1630  
 Pro Thr His Met Lys Ala Ile Leu Thr Tyr Ile Asp Leu Val Arg Met  
 1635 1640 1645  
 Gly Leu Ile Asn Ile Asp Arg Ile His Ile Lys Asn Lys His Lys Phe  
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 Asn Asp Glu Phe Tyr Thr Ser Asn Leu Phe Tyr Ile Asn Tyr Asn Phe  
 1665 1670 1675 1680  
 Ser Asp Asn Thr His Leu Leu Thr Lys His Ile Arg Ile Ala Asn Ser  
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 Glu Leu Glu Asn Asn Tyr Asn Lys Leu Tyr His Pro Thr Pro Glu Thr  
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 Leu Glu Asn Ile Leu Ala Asn Pro Ile Lys Ser Asn Asp Lys Lys Thr  
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 Leu Asn Asp Tyr Cys Ile Gly Lys Asn Val Asp Ser Ile Met Leu Pro  
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 Leu Leu Ser Asn Lys Lys Leu Ile Lys Ser Ser Ala Met Ile Arg Thr  
 1745 1750 1755 1760  
 Asn Tyr Ser Lys Gln Asp Leu Tyr Asn Leu Phe Pro Met Val Val Ile  
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 Asp Arg Ile Ile Asp His Ser Gly Asn Thr Ala Lys Ser Asn Gln Leu  
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 Tyr Thr Thr Thr Ser His Gln Ile Ser Leu Val His Asn Ser Thr Ser  
 1795 1800 1805  
 Leu Tyr Cys Met Leu Pro Trp His His Ile Asn Arg Phe Asn Phe Val  
 1810 1815 1820  
 Phe Ser Ser Thr Gly Cys Lys Ile Ser Ile Glu Tyr Ile Leu Lys Asp  
 1825 1830 1835 1840  
 Leu Lys Ile Lys Asp Pro Asn Cys Ile Ala Phe Ile Gly Glu Gly Ala  
 1845 1850 1855  
 Gly Asn Leu Leu Leu Arg Thr Val Val Glu Leu His Pro Asp Ile Arg  
 1860 1865 1870  
 Tyr Ile Tyr Arg Ser Leu Lys Asp Cys Asn Asp His Ser Leu Pro Ile  
 1875 1880 1885  
 Glu Phe Leu Arg Leu Tyr Asn Gly His Ile Asn Ile Asp Tyr Gly Glu  
 1890 1895 1900  
 Asn Leu Thr Ile Pro Ala Thr Asp Ala Thr Asn Asn Ile His Trp Ser  
 1905 1910 1915 1920  
 Tyr Leu His Ile Lys Phe Ala Glu Pro Ile Ser Leu Phe Val Cys Asp  
 1925 1930 1935  
 Ala Glu Leu Ser Val Thr Val Asn Trp Ser Lys Ile Ile Ile Glu Trp  
 1940 1945 1950  
 Ser Lys His Val Arg Lys Cys Lys Tyr Cys Ser Ser Val Asn Lys Cys  
 1955 1960 1965  
 Met Leu Ile Val Lys Tyr His Ala Gln Asp Asp Ile Asp Phe Lys Leu  
 1970 1975 1980  
 Asp Asn Ile Thr Ile Leu Lys Thr Tyr Val Cys Leu Gly Ser Lys Leu  
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